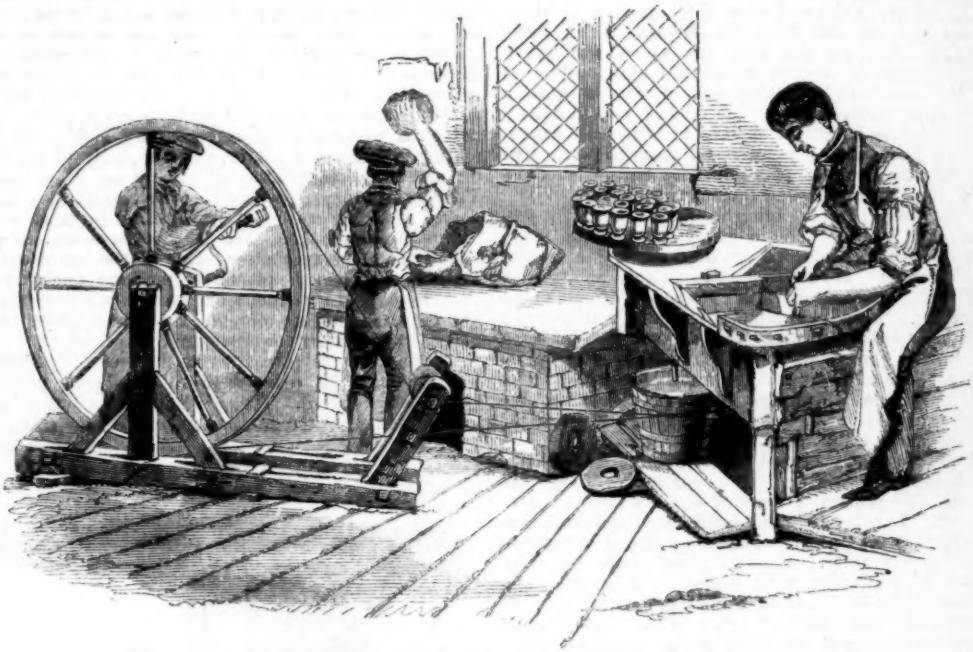
A DAY AT THE ROYAL PORCELAIN-WORKS, WORCESTER.



[Potter's Wheel—'Thrower,' 'Ball-maker,' and Wheel-turner,' at work.]

THOSE among our readers who may have witnessed the remarkable "Chinese Exhibition" near Hyde Park (and well would it be if the price of admission permitted all classes to visit this singular memento of a singular nation), cannot fail to have observed the sumptuous specimens of *porcelain* there deposited—the vases, jars, cups, and other vessels; and may then have conjectured whether or not England can produce specimens equal to these. China has, by a sort of prescriptive right, been deemed the land of porcelain, the country whose inhabitants occupy the first rank in the production of this most delicate, chaste, and elegant semi-transparent material. Thanks to the inquiries and ingenuity of travellers, manufacturers, and men of science—who have discovered the nature of the principal substances employed by the Chinese, the localities in which they may be found in Europe, and who have employed the services of painters far more skilful than any to be found in China—our country now produces specimens of porcelain possessing all those claims to admiration which the "Celestial Empire" has put forth for its manufacture, and—in respect to pictorial embellishment—others in which our Asiatic friends cannot for a moment share.

The "good city of Worcester" is one of the spots in England where the manufacture of the higher kinds of porcelain is located. Those topographers and local historians who love to trace the steps of royalty, have recorded the visits of King George and Queen Charlotte to the "Royal Porcelain-works" at Worcester, as one of the most marked features in the district; and indeed the high fame which Worcester porcelain has acquired gives the town reason to be somewhat proud in the possession of such a manufacture. For a long period two eminent firms among others, viz., Messrs. Flight, Barr, and Barr, and Messrs. Chamberlain, carried on this branch of manufacture independent of each other: but these two firms have now merged into one, which combines the resources of both; and the "Royal Porcelain-works" of Messrs. Chamberlain and Co.—an extended firm—are now the representative of both. To the courtesy of these gentlemen, then, our thanks are due for permission to view and describe the processes conducted in this highly interesting establishment.

Everybody knows that porcelain is the same material as that which is commonly termed 'China' (a name which in itself does homage to the original producers of the substance), but the meaning of the name is not so well known. One authority* says —"The Portuguese traders were the means of introducing the fine earthenwares of China into more general use in Europe; and the name assigned to the fabric, as distinguishing it from the coarser descriptions of pottery of domestic manufacture, was most probably given by them—*porcellana* signifying, in the Portuguese language, a cup;" while another authority† states—"It has been satisfactorily shown by Marsden, that the word porcelain, or *porcellana*, was applied by Europeans to the ware of China, from the resemblance of its fine polished surface to that of the univalve shell so named; while the shell itself derived its appellation from the curved or gibbous shape of its upper surface, which was thought to resemble the raised back of a *porcella*, or little hog." Leaving the reader to select between the 'cup,' and the 'little hog,'

* 'Lardner's Cyclopædia.'

† Davis: 'The Chinese,' chap. 17.

as the forerunner of the name, we will quit this matter by stating that the manufacture to which our attention will be directed is strictly that of porcelain in its most highly finished form, and does not include the commoner kinds of produce classed under the general name of *pottery*.

The factory is situated near the cathedral of Worcester, and not far from the Severn, which flows through the city; and from the upper windows a glance across the Severn shows the blue outline of the Malvern Hills in the distance. In this as in many other large factories there is a central court or area, surrounded by buildings of various forms and dimensions, suited for the processes of manufacture. The general arrangement of these may be indicated by following the processes in their natural order.

First, there is the building in which the crude materials are brought into a plastic or working state. Here we see a ponderous circular stone, nearly four tons in weight, working round in a circle on its edge, and crushing beneath it the stony ingredients of the porcelain. Then, in another part of the building, is a circular vessel, provided with a stirring apparatus, for further preparing the substances by the aid of water. The mixing-room, in another place, contains the vessels in which the pounded ingredients are worked up into a smooth kind of clay, fitted for the purposes of the workman.

Following the prepared material to the hands of the workman, we visit the 'throwing-room,' where the remarkable process of forming circular vessels is conducted. This is a long and busily occupied shop, containing a great number of men employed as we shall describe presently. Kilns in great number are disposed conveniently, with respect not only to the 'throwing-room,' but to the other workshops; for there are 'biscuit-kilns,' 'glaze-kilns,' and 'enamel-kilns,' according to the state of the process in which heat has to be applied to the ware.

Various rooms, called 'placing-room,' 'dipping-room,' 'white-ware room,' 'modelling-room,' 'moulding-room,' 'pressing-room,' &c., are disposed round the open area, for the prosecution of various processes in the course of the manufacture; to which succeed others known as the 'painting' and 'burnishing' rooms, in which those elaborate decorations are given to the manufactured article which form one of the most marked features of distinction between it and common pottery-ware. Then we come to the warehouses in which the finished product is stored. Lastly, there are shops, drying-rooms, and kilns, for the manufacture of the 'tessellated tiles,' which are now becoming so extensively used.

We have glanced at the buildings, and now let us glance at the workmen, and the remarkable processes by which the costly specimens of porcelain are produced. The rough ingredients, too, must have a passing notice.

The ingredients to form porcelain may to many persons seem rather strange. They consist of common flint, flint in the calcined state, Cornish stone, Cornish clay, and calcined bone, all ground and mixed together with water, so as to form a beautifully fine and plastic clay. Numerous and intricate have been the researches into the respective value of different kinds of material, and the particular quality which each one gives to the porcelain. The clay employed, as its name imports, is brought from Cornwall, and is found to possess qualities wanting in most other kinds of English clay. For the commoner kinds of pottery, clay brought from Dorsetshire and Devonshire is largely employed; but for the more exquisite specimens of porcelain this Cornish clay is preferred. Until about a century ago, the strangest views were entertained in Europe respecting the composition and nature of Chinese porcelain; and it was not till after many researches that Reaumur found that the mixture of the two peculiar kinds of earth found in China, called *pe-tun-tse* and *kao-lin*, produced porcelain. It then became an object to discover whether any earths similar to these existed in Europe; and at length Mr. Cookworthy, about seventy years ago, discovered in Cornwall two kinds of earth which nearly answered the desired character. From that time to the present various improvements and additions have been made in the ingredients employed, with a view to produce a porcelain possessing hardness, strength, firmness of texture, whiteness of colour, and a capacity of receiving and retaining colours and gilding on its surface. The Cornish clay is by far the most costly clay employed in such works; but for the finer porcelain it is deemed indispensable. We may perhaps say, in accounting for the respective value of the ingredients, that the clay gives the plastic or working quality, the flint imparts the vitreous or strengthening quality, and the bone aids in producing the semi-transparency for which porcelain is so deservedly admired.

The ingredients have different degrees of hardness, but all must be reduced to an impalpable powder before being mixed. They are laid on a circular bed, as represented in the cut, and ground by the pressure

[Grinding the Flint, Clay, &c.]

of the bulky and ponderous stone roller. They are then transferred to a large circular vessel containing water, and by means of stirrers, sieves, and other appliances, brought into the condition of a creamy liquid, totally free from any gritty particles. It is astonishing to see the degree of fineness thus produced, as manifested by the extreme minuteness of the meshes or interstices of the sieve through which everything must pass before being deemed fitted for the manufacture.

Various depositories or receptacles are provided, in which the ingredients are placed separately during the course of their preparation; and from these they are conveyed to the 'mixing-room,' where they are combined together. Here the experience and judgment of the manufacturer are brought into operation: he has to determine not only the number and kind of ingredients which will produce a ware fitted for service, but also the proportions in which these ingredients are to be combined. It is not improbable

that each eminent firm has a recipe peculiar to itself, as is known often to be the case in the glass manufacture, and many other manufactures in which several ingredients are employed. Without making any guess then, as to the proportions used in the establishment to which our details relate, we may proceed to state that the ingredients are mixed together in large square vessels, the utmost attention being paid to the intimate union of all the different kinds. The mixture presents the appearance of a kind of drab-coloured liquid, which is then evaporated to a certain degree of thickness or stiffness by heat applied beneath it. In short it is by the agency of heat that the cream-like liquid becomes a plastic workable clay, fitted for the hands of the potter. Constant attention is necessary throughout this process, to equalize the rate of evaporation and to retain the ingredients in perfect combination while it is going on.

To the 'throwing-room' and the 'potter's wheel' we now direct our attention, where a process is conducted which has never failed to excite the astonishment of a spectator who witnesses it for the first time; nay, there are many who find the comprehension of the process almost as difficult after many visits as after the first. Never does any one agent appear a more complete master over another than the potter is of his clay: he seems as if he could do anything, everything, with it. At one moment his mass of clay is a shapeless heap; at another a circular cake; then a ball; then a pillar or cylinder, hollow or solid; then a jug; then a basin; a sudden turn converts it into a bottle, or a plate, or a saucer. His hands work and form the plastic material with a rapidity almost inconceivable; and we often doubt where the clay seems to come from, and whither it goes, when one form is being exchanged for another. It is true that, in practice, the potter does not give all these several forms to one individual mass of clay; but a visitor has frequently an opportunity to see that the man *can* do so. What a pity, some may say, that such an elegant process (for such it assuredly is) should be thrown away upon wet dirty clay; but in truth the peculiar state of the clay is the very circumstance which gives to the potter such a command over it. But let us look at the arrangements of the potter's shop before we describe his operations.

Why such a room should be called a 'throwing-room,' or why the formation of circular vessels should be called 'throwing,' it does not seem very easy to determine. There is a circular motion in pottery-throwing and also in silk-throwing; but why the same term should be applied in both cases, or why applied at all, we do not see. We believe, however, that 'throw' is a provincial name for a lathe; and if so, an explanation is easily provided, by considering the potter's wheel as a lathe or throw. The throwing-room, however, be its appellation good or bad, is an oblong room, containing a great number of benches and pieces of apparatus, at which men are employed making circular articles of soft porcelain.

Our frontispiece shows one of the most ancient working tools, or machines, which any branch of manufacture can exhibit—the 'potter's-wheel.' Scarcely any other machine has lived so long and undergone so little change. On the Egyptian monuments and on other records of antiquity there are representations of the potter's-wheel similar in all the essential particulars to those of our own day; indeed nothing can be more simple than the construction. In the potter himself, and not in the wheel, lies the merit of the work executed. The potter sits on a kind of stool or bench, immediately behind a small circular whirling-table. His knees are placed one on each side of the central support of the machine, so as to give him a command over it. This, which we have called the whirling-table, is simply a circular piece of wood, whose breadth is sufficient to support the widest vessel that is to be made: it is fixed on the top of a vertical stem or shaft, so that if the shaft be made to rotate, the piece of wood must rotate likewise. The apparatus is rather below the height of a common table. The clay which is to be formed into a vessel is put upon the circular board, and there remains till fashioned; the board and the shaft beneath being made to rotate horizontally, while the potter with his hands gives the form to the mass of clay.

Every potter, or 'thrower,' is attended by two boys, who are called the 'ball-maker' and the 'wheel-turner.' The former of these has before him or near him a mass of prepared clay, having precisely the quality and consistence required for the potter's operations. He separates the clay into smaller masses, each suited to the manufacture of one particular kind of vessel, and works it up into a rude kind of ball, convenient to be handled by the thrower. He is in every way the servant or helper to the thrower. The services of the 'wheel-turner' depend on the manner in which the circular piece of wood is made to rotate. In the early state of the porcelain manufacture in England, the perpendicular shaft beneath the board was put in motion by a wheel provided with spokes, which the 'thrower' moved with his foot; the labour however was so great, that this method became unsuited to the production of large articles. Another method in past times was, to have a crank in the middle of the shaft, with a long rod working upon it, and motion was given to the lathe by the rod being pushed backward and forward. The customary mode at the present day is, however, to have a rope passing from a pulley upon the perpendicular shaft to a large wheel at a distance, which wheel is turned by a boy under the directions of the 'thrower.'

With this very simple kind of lathe, and with a few small tools still more simple, does the workman proceed to fashion all those articles of porcelain which are circular in their form, whether cups, basins, or vessels of any other kinds. When the shape is too diversified to be deemed circular, other modes of formation must be adopted, of which more hereafter. Let us suppose, as an example, that a hemispherical basin is to be formed. The man places a mass of clay, in size and consistence suited for the purpose, upon the bed of his lathe or wheel, striking it down rather forcibly as a means of making it hold firmly to the wood during the process of formation. He gives directions to his 'wheel-turner' to set the machine in motion, and then forms the shapeless mass into a vessel, chiefly by his hands. With his hands, wetted in an adjacent vessel of water, he presses the clay while rotating, and brings it into a cylindrical form; this cylinder he forces again down into a lump, and continues these operations—squeezing the clay into various shapes—until he has pressed out every air-bubble from the body of clay, a precaution of very great importance. Then pressing the two thumbs on the top of the mass, he indents or hollows it, as a first germ of the internal hollow of the vessel. Once having the least semblance of a cavity within, he proceeds with a rapidity almost marvellous to give both the outward and the inward contour to the vessel. With the thumbs inside and the fingers outside, he so draws, and presses, and moulds the plastic material, as to give to the outside a convexity, to the inside a concavity, and to the whole substance an uniform consistency, without breaking the clay or disturbing the circular form of the vessel. It will be seen on a moment's consideration that this circular form is due to the rotation of the clay, while the fingers and thumbs are stationary, just as a turner

holds his cutting-chisel stationary while the piece of wood is rotating.

During the pressure of the hands upon the clay, a minute change in the amount or direction of the pressure would transform the basin into a saucer, or into any other vessel whose degree of curvature is very different from that of a basin. The oddness of these transformations might often make a spectator smile, were not his admiration excited by the cleverness and dexterity of the workman who produces them. According to the shape and size of the vessel, the 'thrower' requires the wheel and the mass of clay to rotate with varying degrees of velocity, in which he instructs his 'wheel-turner.'

The general contour of the vessels, inside and out, is given by the thumbs, fingers, and palms of the hands. But as this could not insure accuracy sufficient, the workman is provided with small pieces of wood called 'profiles,' or 'ribs,' each of which is shaped in accordance with either the exterior or the interior of some particular kind and form of vessel. Holding one of these 'ribs' in his hand, and applying it to the surface of the clay, the workman scrapes off the superfluous portion at any protuberant or misshapen part, and makes the whole circumference conform to the shape of the rib. The fragments thus removed, technically called 'slurry,' he throws aside among the unused clay. If a number of vessels are to be exactly the same size, the workman sometimes fixes pegs in the stand on which the clay is placed, which act as a guide to him in regulating the diameter to which the clay is to be expanded, and beyond which it must not reach. When the vessel, by the aid of the hands and the small working tools, is formed, it is cut from the supporting piece of clay or from the board by means of a piece of brass wire, much in the same manner as barrelled butter is cut into slices, and the newly-formed vessel is placed on a board or shelf to dry.

In this manner vast varieties of vessels are formed, comprising all those which present, both on the exterior and the interior, an uniform circularity. And indeed not only are vessels thus formed, but masses of clay are similarly brought into a cylindrical form, as a nucleus from which ornamental articles may afterwards be produced at the turning-lathe. Within the last few years the use of porcelain has greatly extended, in relation to articles both useful and ornamental. Candlesticks, taper-stands, fancy baskets, door-handles, finger-plates, and a host of other articles, are now made of this material; and if the form is such as can be given by the lathe, a mass of clay is first worked by the hand into something like a cylindrical shape, as a preparative for the operations of the turner. The floor of the 'throwing-room' at the factory under notice was filled with these cylindrical masses, technically called 'solids,' some of which were to be turned at the lathe into banister-rails for staircases, and others into articles of various other kinds.

The operation of turning these articles is effected very much in the same manner as the turning of wood. The 'solids' are allowed to remain until, by the evaporation of moisture from the damp clay, they have acquired a degree of dryness which is known among the workmen as the 'green state,' in which state the shaping and smoothing of the surface are better effected than when the clay is either damper or drier. As a turner in wood can produce an internal cylindrical cavity as well as a circular exterior, so can the porcelain-turner; and it is in this way that candlesticks and similar articles are brought to the required shape.

We have now, in supposition, made circular vessels, and turned them to the required shape and smoothness. But before we follow them through their subsequent progress, it is desirable to witness the production of those articles which neither the potter's wheel nor the lathe will produce; articles which exhibit in an especial degree the magnificence and delicacy of the finer kinds of porcelain. This will take us to the workshops of the 'pressers,' the 'mould-makers,' and the 'modellers;' for the decorated articles are produced by pressing or by pouring clay into moulds, which moulds must previously be made from models, and which models must have been before formed by hand. Hence the modeller is the all-important workman whom we must first visit.

In an upper room of the factory are the operations of the man of taste, the 'modeller,' conducted. Here, whatever our Schools of Design, or education, or natural ability could afford, in the development of a knowledge in elegance of form, is important and valuable. The modeller, from drawings made either by himself or by others, has to build up in clay the exact representative of the article to be formed in porcelain. From the handle of a tea-cup up to the most elaborate combination for a piece of drawing-room porcelain furniture, the modeller has to prepare an accurate original in soft clay. Provided with a supply of clay, especially prepared for this kind of work, and with a few simple tools, he elaborates the various parts of his design, whether animals, fruit, flowers, foliage, architectural ornaments, arabesques, or any of the countless varieties of decorative devices; building up his model piecemeal, and carving or cutting out the parts as he proceeds. It has been aptly observed by Mr. Porter, that "the taste of the modeller is put in requisition; calling for the execution on his part of a high degree of skill and ingenuity in forming patterns, and adapting to them appropriate ornaments. To be a perfect modeller, in the higher branches of the art, a man should have an acquaintance with the best productions of the classic climes of Greece and Rome; he should be master of a competent knowledge of the art of design; his fancy glowing with originality, tempered and guided by elegance and propriety of feeling, and restrained by correctness of taste and judgment. To a man thus gifted, the plastic and well-tempered material wherewith he works offers little of difficulty in the execution of his conceptions."

When we visited the *studio* of the modeller at these works, he was engaged upon an elaborate model of a kind of tripod or stand, comprising a vast number of parts, all highly decorated. It is only in the costly articles which require *casting* that the model is thus elaborate: when it can be produced by *pressing*, the preparation of the model is generally more simple. The difference between these two modes of manufacture is this:—that, in pressing, the shallowness of the mould is such that clay, in its usual plastic state, can be pressed into all the minute devices of the mould; while, in casting, the mould is so deep and elaborate that the clay has to be poured into it in the state of a cream-like liquid. Plates, saucers, oval vessels, lids, spouts, handles, and a large variety of articles which are too irregular to be produced at the potter's-wheel and the lathe, and yet not so complex as to require casting, are produced by pressing. But both for pressing and for casting moulds must be made, and these moulds are reversed copies of models produced by the modeller; so that this workman's services are required for all.

Plaster of Paris, prepared in a particular way, is the substance of which the moulds are made. The making of the moulds is quite a distinct occupation from that of modelling, and is carried on in a different part of the factory. A casing of clay is first formed and securely fixed round the model, leaving sufficient space between it and the model for the substance of the

mould. The plaster of Paris, being mixed with water to a cream-like liquid, is then poured into the vacant space. In a very short time, in virtue of the well-known qualities of this substance, the plaster solidifies into a compact mass, which is easily separable from the model. The interior of this mould is then found to give a perfect counter-representation of the exterior of the model, in all its minuteness of detail. The model is lastly dried, to prepare it for further use.

For pressing, the mould is sometimes made in two parts, one half of the figure being on one side, and the other half on the other; the two being made to fit accurately together. Clay is pressed into each half of the mould, and cut off flush, so as to have no superfluity; and the two halves of the mould being brought closely together, each piece of clay receives its impress from the half of the mould in which it lies, and the two pieces are at the same time joined together: so that one piece is produced, presenting a fac-simile of both halves of the mould. This mode is adopted in the preparation of a large diversity or variety of articles. Another arrangement, for the production of plain handles, spouts, &c., is to force clay through an orifice in the bottom of a cylinder, the orifice having that shape which is to be given to the clay. A third arrangement, where one surface of a shallow vessel, such as a saucer or a plate, requires to be moulded, while the other can be formed without a mould, is to lay a flat piece of clay on the mould, press it down with a wet sponge, and give a proper form to the exposed surface by a profile or gauge applied to the wet clay while the latter is revolving. The annexed cut represents a few ornamental articles which required to be produced by pressure, and the moulds used in the pressing.

[Moulds for Porcelain, and Casts.]

So varied and numerous are the articles now made of porcelain, that it would be utterly impracticable to classify them all in respect of the mode of manufacture; but it will suffice to say that all are produced by one or other of the modes above noticed, viz., throwing at the wheel, aided by profiles or gauges; turning at the lathe; pressing through an orifice in a cylinder; pressing one side on a mould, while the other side is fashioned by a gauge; pressing between two moulds, or the two halves of a mould; and casting while the clay is in a liquid form. In the last-mentioned mode of proceeding, the plaster of the mould quickly absorbs water from the liquid clay which lies in contact with its surface, and brings it to a solid state; and a hardened shell having been thus produced, the subsequent arrangements are such as to make the cast either hollow or solid, according to its form and dimensions.

Many a tea-drinker has probably marvelled how the handle of a tea-cup is produced; whether it is fashioned by hand out of the same piece of clay which forms the cup, or cast in a mould with it, or fixed on separately. The preceding details will have prepared us to understand the real state of the matter,—that the cup, if not too elaborate in form, is 'thrown' at the wheel; that the handle is pressed in a mould, and that the one is afterwards affixed to the other. Handles, spouts, knobs, and small raised ornaments are all attached to the vessels in a similar way, and when the latter are in the 'green state,' between wet and dry. The cement employed is simply a creamy mixture of clay and water, technically termed 'slip,' which is applied to the two surfaces to be joined together, and which enables them to adhere permanently. The clay handle or spout is in such a soft state, that considerable neatness and dexterity are requisite, especially in curving the strip of pressed or moulded clay which is to form the handle—a process represented in the annexed cut. The raised or relief orna-

[Fixing Handles.]

ments seen on articles of porcelain are made separately in a mould, and cemented on the vessel by the aid of 'slip,' except when the vessel is of such a kind as to require to be cast or pressed, in which case the ornaments are generally made as part of the pattern itself in the mould. Some of the workmen at the factory were engaged in preparing elegant little taper-stands, the construction of which illustrates conveniently the combination of the different modes of manufacture: for the lower saucer or dish had been pressed in a mould; the nozzle had been made into a 'solid' at the wheel and then turned at the lathe; the handle had been formed in a double mould; and lastly, all these were joined together with 'slip.'

Let us suppose, then, that we have traced all the various kinds of porcelain articles to a finished state in respect of their form and decorations; the tea-pots furnished with handles and spouts, the cups with

handles, the jugs with lips, and the more highly decorated articles provided with all which the 'thrower,' the 'turner,' the 'presser,' and the 'caster' can do for them. We shall next be prepared to follow them through the subsequent processes which impart that exquisite appearance so especially belonging to porcelain.

Adjacent to the buildings where the early stages of the manufacture are carried on are four 'biscuit-kilns,' in which the ware is exposed to an intense heat. These kilns are probably about fourteen feet high, and nearly as much in diameter. They are heated by fires ranged round the circumference, each kiln having eight fire-places. The whole interior capacity is fitted for the reception of the articles to be 'fired,' or 'baked.' Very great precautions are necessary in this process; for, if the smoke or flame from the fire attacked the porcelain, it would discolour it at once, and spoil it. To prevent this mischance, all the manufactured articles are put into receptacles called 'seggars,' such as are here represented: these

[Putting manufactured articles into 'Seggars.']

are made principally of a kind of fire-clay capable of resisting an intense heat; and so important are they, that the acquisition of the sort of clay fitted for the purpose has always been deemed a momentous point on the part of the manufacturer. The seggars are of various sizes, shapes, and depths, to suit the different pieces they are to contain. According to the size and shape of the articles, they are either enclosed one in each seggar, or several in each; but in the latter case precautions are taken that they should not adhere together, nor touch each other at more than two or three points: powdered flint is placed at the bottom of the seggars, and pieces of hard fire-clay are so placed within the seggar, that the articles may be supported with as little contact as possible one with another.

The piling of the seggars in the 'biscuit-kiln' is a singular arrangement. The whole interior is filled with them. The top and bottom of each seggar (the former open and the latter closed) being flat, they may be piled one on another, so that each one forms a cover for the one underneath. As the heat cannot be perfectly equalized throughout the kiln, care is taken that the larger articles shall be exposed to a higher temperature than the smaller. Thus seggar is laid upon seggar, and pile after pile built up within the kiln, till the whole is filled. Every aperture is then carefully closed—of which the main one is, of course, the door through which the men enter the kiln—and all is ready for the fires to be lighted beneath. The general appearance of the kiln while being filled is here represented.

['Placing the 'Seggars' in the 'Biscuit-kiln.']

We do not know whether it is a customary arrangement in porcelain factories generally, or whether it merely applies to the one which is the object of our visit; but here the kiln-fires are lighted at a very early hour on Friday morning, and the articles are kept exposed to a fierce white heat throughout Friday and Saturday, forty hours being about the length of time during which they are thus exposed. The precise amount of 'firing' necessary is a delicate point, to be determined only by experience: it must be sufficient to expel all the moisture, and to convert the clay into a kind of semi-vitreous earth, but not beyond this point.

The baked articles are allowed to cool gradually before being drawn from the kiln; and when so drawn they have acquired the state which is called 'biscuit.' Every article shrinks considerably while in the kiln, and the weight is very materially lessened. The biscuit-ware has a peculiarly delicate, soft, and white appearance, presenting many points of striking difference compared with its unbaked state. Every article, as taken out of the seggar, is nicely cleaned, to remove all symptoms of flint-dust, &c.; and it is then ready for the process of 'glazing,' by which the dead and

unpolished surface of the biscuit is converted into a beautiful glassy surface.

One of the most important steps in the progress of the porcelain manufacture has been the discovery of substances fitted to impart this 'glaze' to porcelain. Any of the substances which will make glass will afford a glaze to pottery; and these substances comprise various alkalies, various oxides of metals, and flint in a variety of forms: but what is the best combination to form a glaze for the more delicate kinds of porcelain is a question which has occupied much attention, not only among manufacturers, but among chemists also. In the commonest kinds of earthenware or pottery the cheapest ingredients are those most resorted to; but in costly porcelain a totally different system is pursued, the excellence of the material being a much more important matter than the smallness of the price. We believe that in this, as in the choice of clays for making the porcelain, each large establishment has a recipe of its own, derived from the experience of the proprietors.

In one part of the factory is a room called the 'dipping-room,' adjacent to four 'glaze-kilns.' In the dipping-room are troughs or wooden vessels containing the glaze, a whitish creamy liquid. The room is kept at a moderate warmth, and is provided with conveniences for placing the porcelain articles, both before and after being dipped. The pieces of 'baked' or 'fired' porcelain being brought into this room, a workman takes them up one by one, holds them in such a manner that there shall be the smallest amount of contact between them and his fingers, and dips them into the trough of glaze. By one of those manipulations which are peculiar to most occupations, he turns the vessel about, on removing it from the glaze, in such a manner that, while every part shall be coated, none shall have any superabundance but what may easily be drained off. The vessels are put down out of his hand, one by one, on a board, which is thence carried to the 'glaze-kiln placing-room.' In this latter room they are piled up in seggars, nearly in the same way as before, but with certain modifications to suit the peculiarity of the circumstances.

The glaze-kilns, like the biscuit-kilns, are each heated by eight fires, and are each filled up with piles of seggars; but in the glaze-kilns the slight opening between the several seggars of each pile is stopped with clay, to prevent more effectually the entrance of smoke and flame into the seggar. The heat for vitrifying the glaze is much less intense than for biscuit-firing, and is continued for a much smaller number of hours. The operation consists in driving off the watery parts of the glaze, and melting the vitreous part, which, in a vitreous state, combines firmly with the biscuit. Where we find, in the cheaper articles of manufacture, the glaze to become discoloured, or the ware discoloured under the glaze, or the glaze intersected by myriads of minute cracks, this always indicates either that a bad choice of ingredients was made, or that the management of the glaze-kiln was injudicious; and this is one of the many points in which first-rate porcelain shows its excellence.

We have now brought the porcelain to what might be deemed a finished state, so far as regards the actual service demanded from it: but it is very rarely that such porcelain as we are now considering leaves the hands of the manufacturer in this state; it is nearly always decorated either with painting or gilding, or both, before it passes into the hands of the customer. We follow it therefore to one of the largest and most interesting rooms in the factory, known as the 'painting-room.' This is a long room, provided on both sides with rows of windows, through which an ample supply of light is obtained. Close to the windows are a range of tables, at which the painters are seated, each one with his side to the light. At the time of our visit a large number of persons were thus engaged, each one holding in his left hand some article or other of porcelain which he was painting with his right. The odour indicated that various mineral colours, mixed up with oil and turpentine, formed the material of the paint. Each man had a pallet of colour before him, which he laid on the porcelain with a camel-hair pencil, much in the same manner as a miniature-painter would do.

In China this branch of manufacture is so subdivided, that one man paints blue, another red, another yellow, &c., so that each article goes through a great number of hands during the process of painting. But in England the subdivision is more rational. One man takes flowers, another foliage, a third animals, a fourth landscape, a fifth figures, a sixth heraldic bearings, and so forth; confining themselves mainly to that which their taste and studies have enabled them to effect artistically. Consequently, in walking from one part of the painting-room to another, we witnessed in succession the labours of all these classes of artists. Each painter holds the piece of porcelain against a projecting part of his table, so as to retain it firmly; or else, if a circular ornament is to go round it, he rests it on a support which may enable it to rotate with facility. The colours employed in this process are chiefly oxides of various metals, worked up to a liquid state with spirits of tar and of turpentine, and amber oil. Those ornaments which are subsequently to present the brilliant golden appearance so familiar to us on the better kinds of porcelain, are effected by a preparation of refined gold mixed up with some of the liquids just mentioned into a dark brown colour, which has no semblance to a golden hue until after it has been burned in a kiln.

Some of the articles of porcelain have a white or unpainted ground, decorated with coloured ornaments; while others are painted over the whole surface with a ground colour, the laying on of which is the work of a particular set of painters, who show great art in the uniform tinting produced. For instance, we saw some of the painters engaged on a costly service of porcelain for the distinguished Hindoo who has recently visited England—Dwarkanauth Tagore, in which the ground was a delicate tint of green, produced by a different manipulation from that which imparts the decorative devices. In some parts of the room there were heraldpainters engaged on articles of porcelain for the mess-rooms of some of our regiments and for noble families, the arms of the regiment or of the family being painted in more or less detail on each piece of porcelain. Not only are vessels for table-service thus painted, but the side-slabs for fire-places and a large variety of decorative furniture are now made in porcelain, and then subjected to the taste and skill of the painter. This is one of the branches of the porcelain manufacture in which the English have made very rapid progress within the last few years.

Conveniently placed with respect to the painting-room are the 'enamel-kilns,' in which the painted articles are exposed to a heat sufficient to make the colours adhere to the porcelain. These kilns are a kind of arched oven, having a door at one end, and gratings within on which the articles are placed. The most scrupulous care and delicacy are displayed in managing these kilns, as to the temperature and length of exposure. Sometimes the painter requires to partially heat the porcelain two or three times during the process of painting, to ascertain the effect of his colours, and to combine them well with the porcelain. Indeed the care required in this process is very little less than in the exquisite one of enamel-painting.

We next follow the costly results of all the preceding labours to the 'burnishing-room,' a large apartment occupied by women and girls employed in burnishing those parts which have been gilt in the painting-room. The burnishers are formed of blood-stone and agate, brought to a very smooth surface, and variously shaped to adapt them to the curvatures of the porcelain. Each workwoman is seated at a bench with her face towards a window, holding the porcelain in the left hand, and the burnisher in her right, with which she rubs the gilded parts until they are brought to a brilliant gloss. The warehouses of the firm—of which there is one in the High Street of Worcester, and two in London, in Coventry Street and in Bond Street—illustrate in a striking degree the progress made by our manufacturers in the production of those luxurious articles for which Sèvres and Dresden obtained, in past times, such celebrity

TESSELLATED TILE MANUFACTURE.

We must in closing say a few words respecting a branch of manufacture which promises to be much extended in England, viz. *tessellated tiles* for pavements, &c. Whoever has seen the Temple Church since it has been renovated, will have noticed the beautiful pavement which it displays, formed of a vast number of rectangular tiles about six inches square, glazed on the upper surface. The establishment to which this 'visit' relates is one of those wherein tiles of this kind, a specimen or two of which are here depicted, are made.

[Tessellated Tiles.]

The tessellated tiles are formed of two differently coloured clays, one imbedded in the other, and disposed so as to form an ornamental device. The tile is first made in clay of one colour, with a depression afterwards to be filled with clay of the other colour, and this depression is formed by the aid of a mould. In the first place, the modeller models in stiff clay an exact representative of one of the tiles, about an inch thick, cutting out to the depth of about a quarter of an inch the depression which constitutes the device. When this is properly dried, a mould is made from it in plaster of Paris, and from this mould all the tiles are produced one by one. The ground-colour of the tile is frequently a brownish clay, with a yellow device; but this may be varied at pleasure. Let the colour be what it may, however, the first clay is mixed up very thick, and pressed into the mould by the aid of the press seen in the next cut. On leaving the press it presents the form of a damp, heavy, uncoloured square tile of clay, with an ornamental device formed by a depression below the common level of the surface.

[Making the Tiles.]

The second-coloured clay, so far from being made stiff like the first, has a consistence somewhat resembling that of honey; and herein lies one of the niceties of manufacture, for it is necessary to choose clays which will contract equally in baking, although of different consistence when used. The tile being laid on a bench, the workman plasters the honey-like clay on it, until he has completely filled the depressed device, using a kind of knife or trowel in this process. The tile, in this state, is then allowed to dry very gradually for the long period of eight weeks, to accommodate the shrinking of the clays to their peculiar natures. After this, each tile is scraped on the surface with an edge-tool, till the superfluous portion of the second clay is removed, and the two clays become properly visible, one forming the ground and the other the device. In this state the tiles are put into a 'biscuit-kiln,' where they are baked in a manner nearly resembling the baking of porcelain, but with especial reference, as to time and temperature, to the quality of the clays. From the biscuit-kiln they are transferred to the 'dipping-room,' where they are coated on the upper surface with liquid glaze by means of a brush. Lastly, an exposure to the heat of the 'glaze-kiln' for a period of twenty-four or thirty hours causes the glaze to combine with the clay, and the tiles are then finished.

The substance of which these tiles are made cannot be called *porcelain*, but the care required in their manufacture is such as to remove them from the rank of common pottery, and to form a sufficient reason for their being made at the very interesting establishment here described, and of which we now take our leave.